25X1

INSTRUCTION SHEETS

IMAGE QUANTIZER

August 1968

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LIST OF ILLUSTRATIONS

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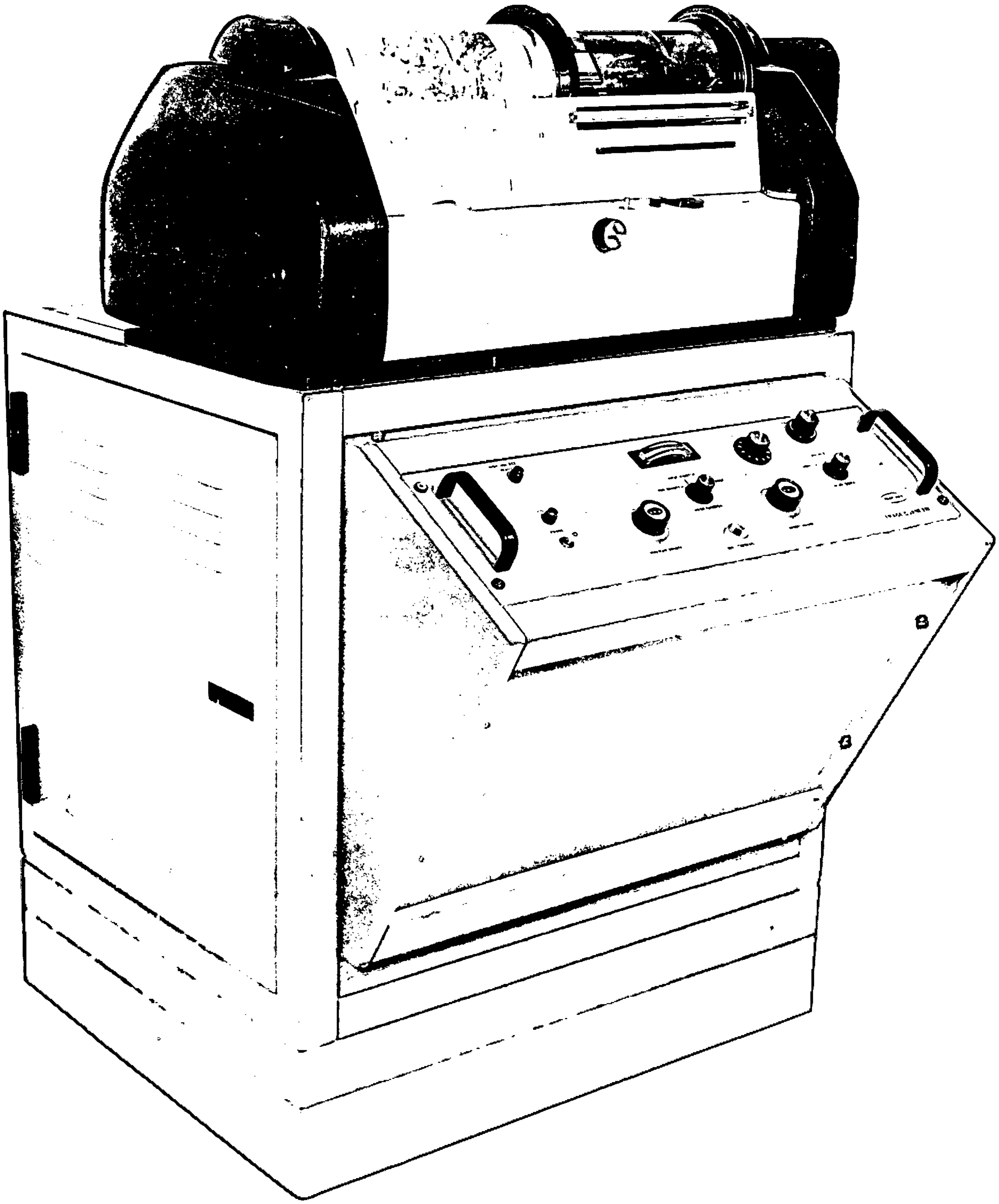

Image Quantizer Type AS-2

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OPERATING INSTRUCTIONS

IMAGE QUANTIZER

INTRODUCTION

The Image Quantizer (IQ) is a high speed film base transparency reading device capable of scanning an 8-1/2 x 11 inch specimen in 8 minutes at a resolution of 200 lines per inch. Resolutions of 400 and 600 lines per inch are also available at 16- and 24-minute scan time, respectively.

A precision glass drum is used as the specimen table. A light source and condenser lens is supported on a track within the drum. A scanning objective, aperture holder, and photomultiplier assembly are mounted on a second track beneath the drum. The two assemblies are linked together by a stainless steel band and pulley assembly. This arrangement maintains the optical alignment of the scanning aperture and the light source.

The film specimen, when taped to the drum, lies in the focal plane of the condenser lens and objective. Apertures ranging from 0.2 mm to 2.0 mm are provided to permit scanning of a wide range of specimen types.

The Image Quantizer is designed to cover a range of 0 to 3D density units. The range of 3D is broken up into 64 separate levels of 0.047D per step. A range control provides reduction of the scanning range down to 0.64D or 0.01D per step. A density level control is also provided to be used in conjunction with the range control to set the start of the scanning range at any point between 0 and 3D.

Printout is accomplished on electrosensitive paper mounted on an aluminum drum with a wire stylus pulsed at a 18 kHz rate. The printout is a repetitive 4-level code: white, light gray, dark gray, and black in order of decreasing density. A contrast control is provided to adjust the shading of the output code to a readable level. A meter and function selector switch provide the necessary monitors to properly set up the IQ for a particular specimen.

The Image Quantizer has three modes of operation:

<u>Digital X.</u> The digital X mode of operation provides a direct quantized output of 64 discrete levels in a four color repetitive code. Note the density per level is a function of the density range control.

Digital X′. The digital X′ mode of operation provides the derivative of the quantized output producing contour lines at the mid-level and crossover points of each of 64 discrete density levels.

Analog X′. The analog X′ mode of operation produces the quantized derivative of the photomultiplier amplifier output. The output format is the same as the digital X mode of operation. The differential time constant can be varied in decade steps by the front panel control.

FIGURES AND ILLUSTRATIONS

The numbered figures and illustrations pertaining to the Image Quantizer are located in the following pages. Schematic diagrams are listed here for reference; a copy of each schematic is folded and inserted at the back of these instructions.

Size	Number	Description	Sheets
C	202249A	Schematic, Front Panel, Image Quantizer	1
E	201690A	Logic Diagram, Image Quantizer	2
C	201662A	Half Bit Logic Card and -12V Power Supply Schematic	1
D	201689A	Schematic, Sweet Circuit Chassis	1
E	201699A	Interconnection Diagram, Image Quantizer	1
D	201812	Schematic Diagram, Gestetner Rework—Image Quantizer	1
C	201721	Schematic, Photomultiplier	1

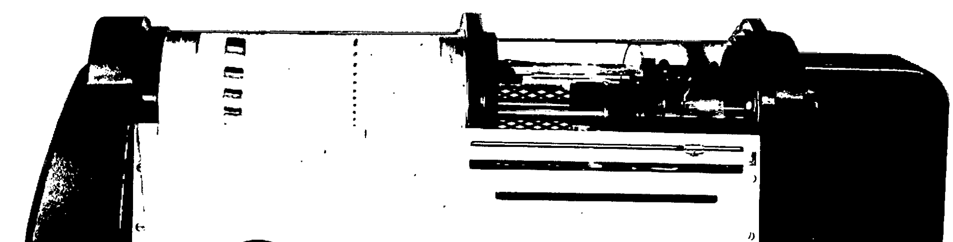

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Fig. 1. Image Quantizer

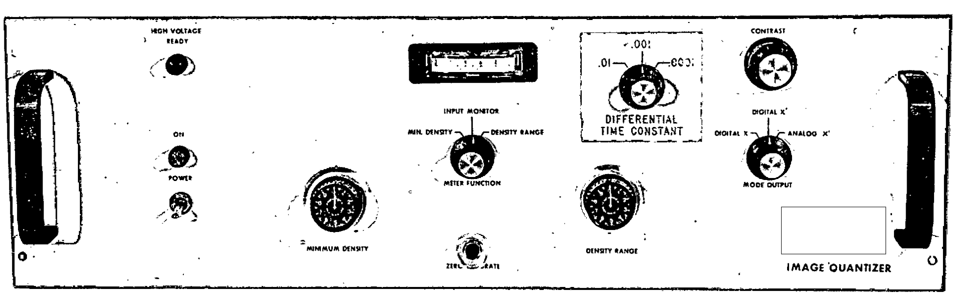

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Fig. 2. Control Panel

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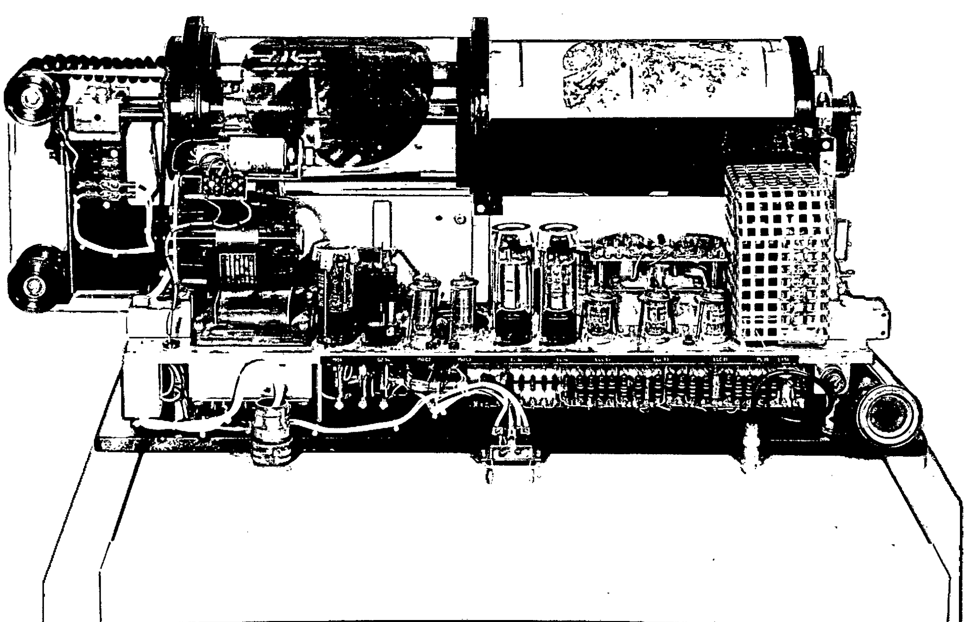

Fig. 3. Image Quantizer Rear View — Covers Removed

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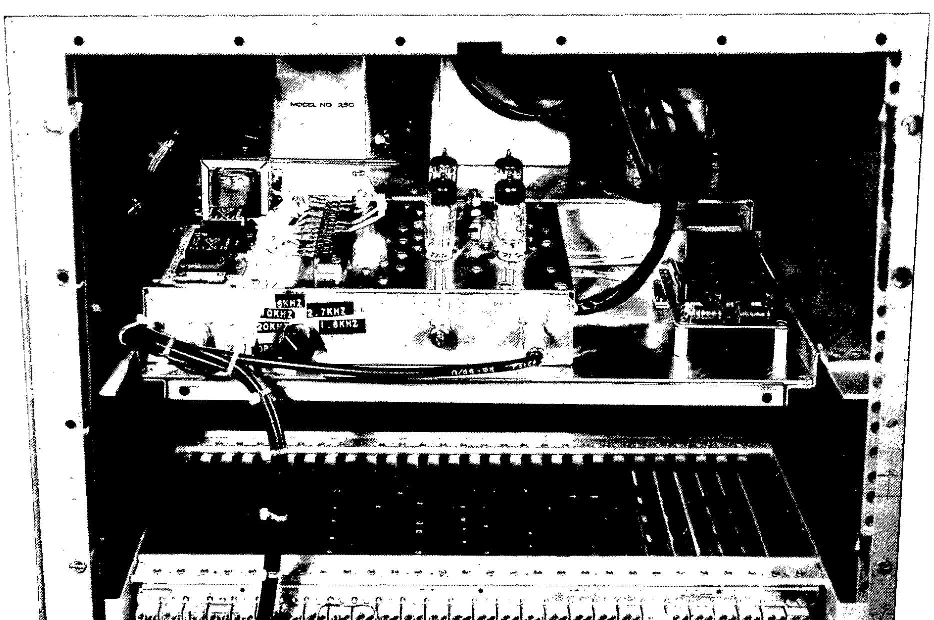

Fig. 4. Electronics Cabinet Right Side View

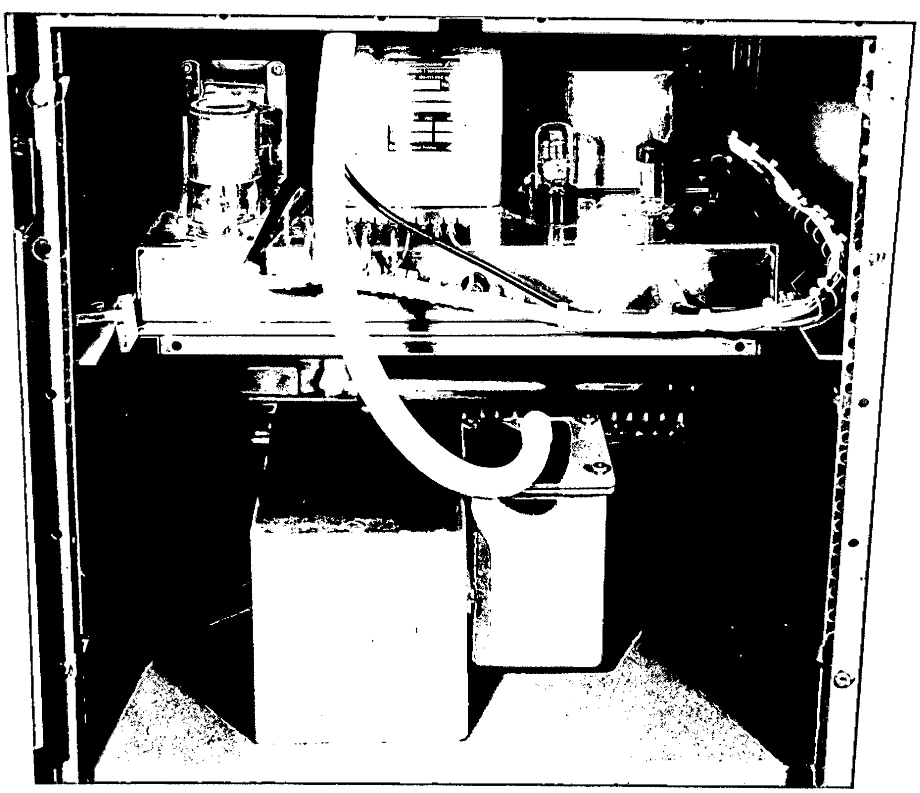

Fig. 5. Electronics Cabinet Left Side View

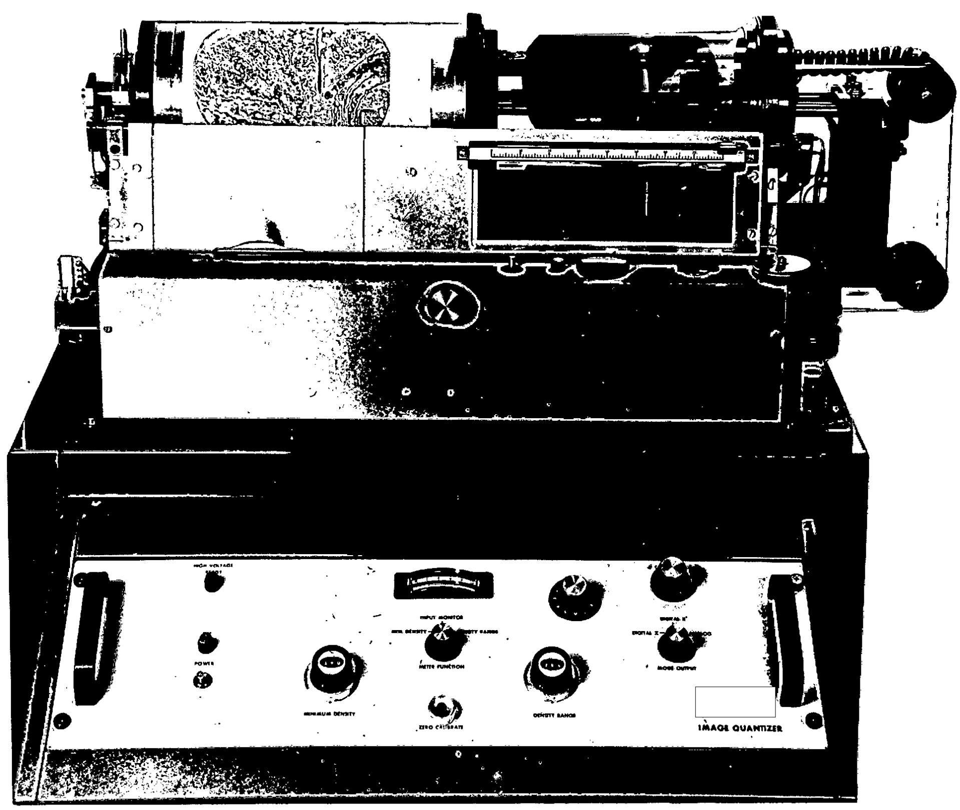

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Fig. 6. Image Quantizer Front View — Covers Removed

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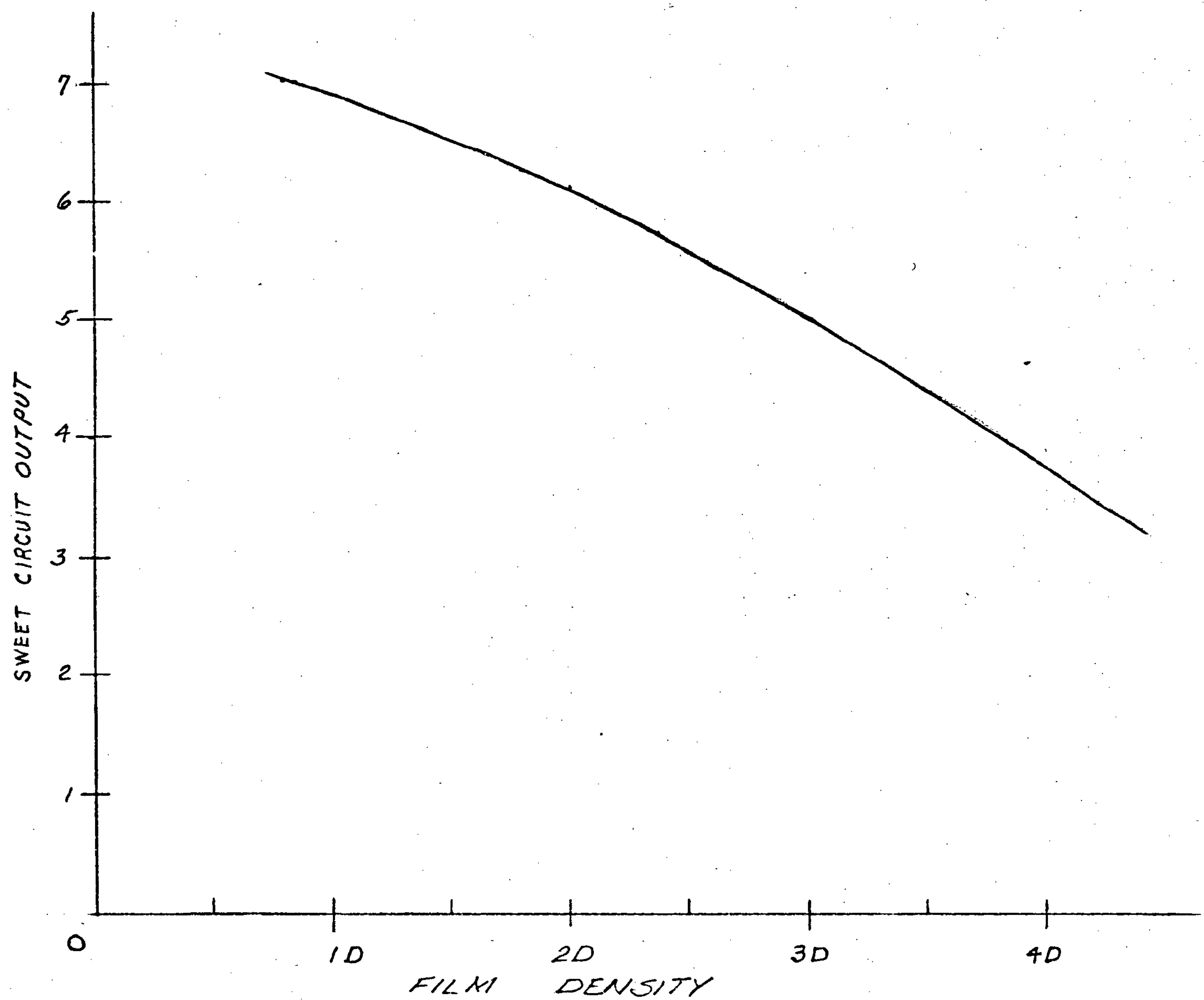

Figure 7. Typical Calibration Curve

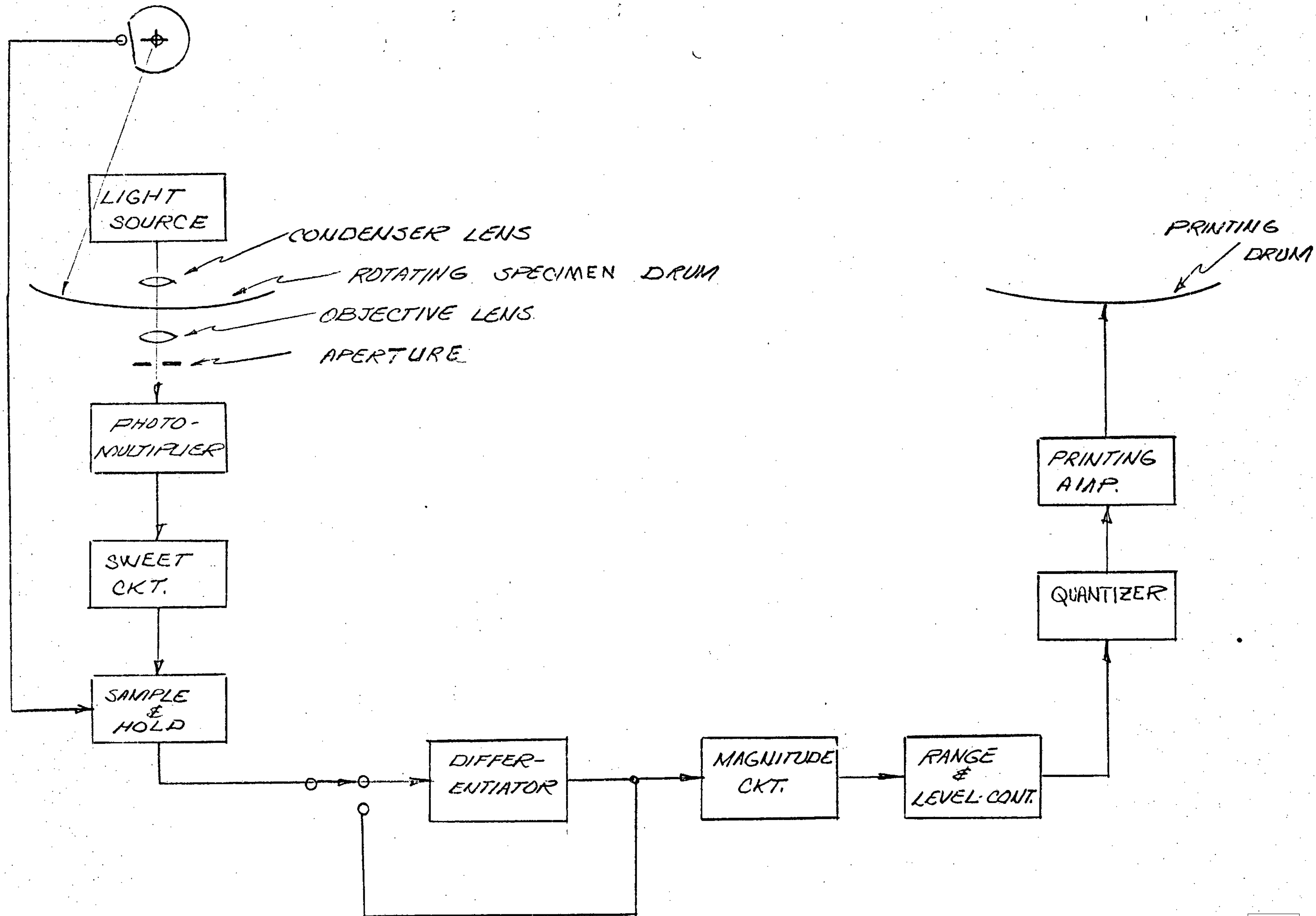

Figure 8. Image Quantizer Block Diagram

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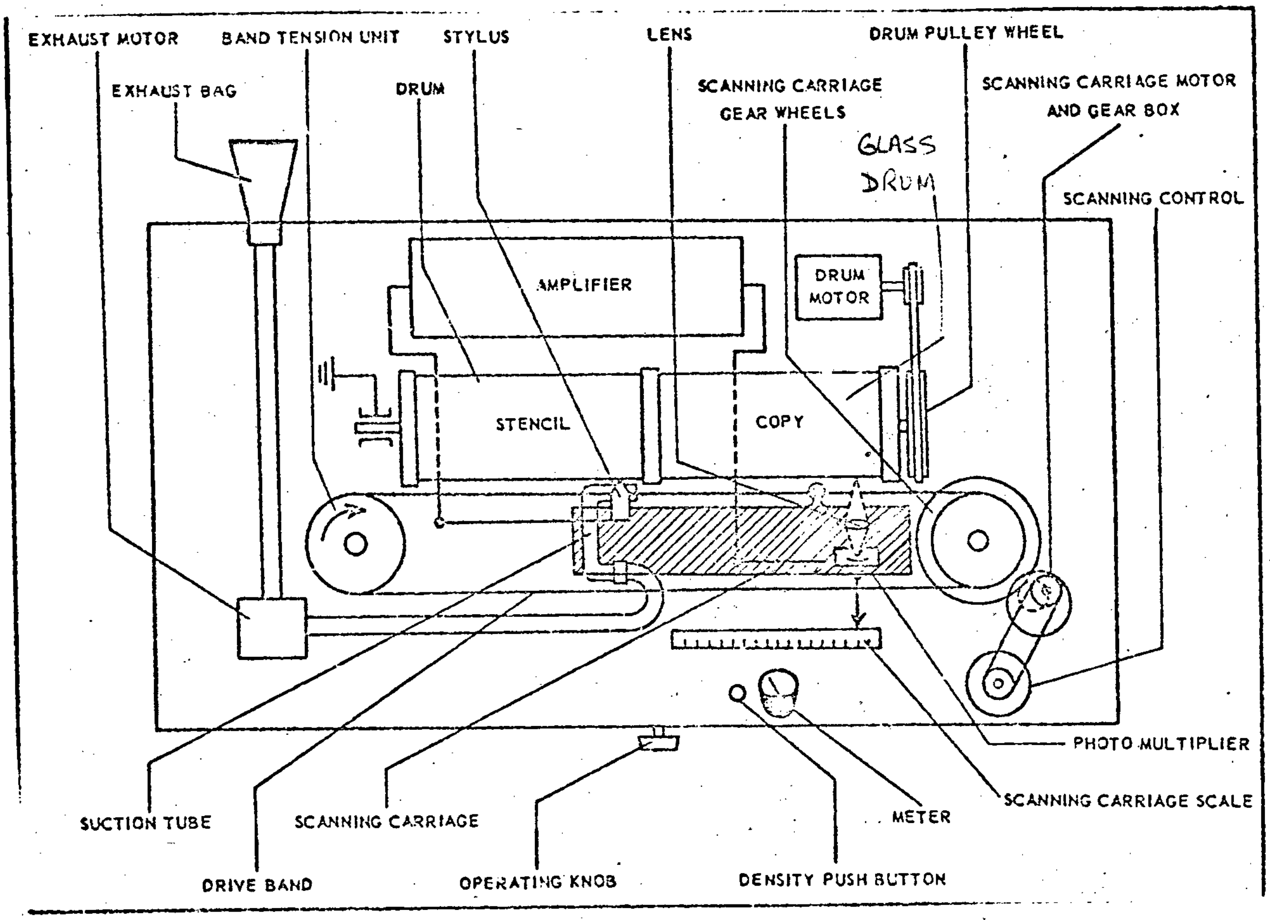

Figure 9. Composite Plan View of Gestefax Unit

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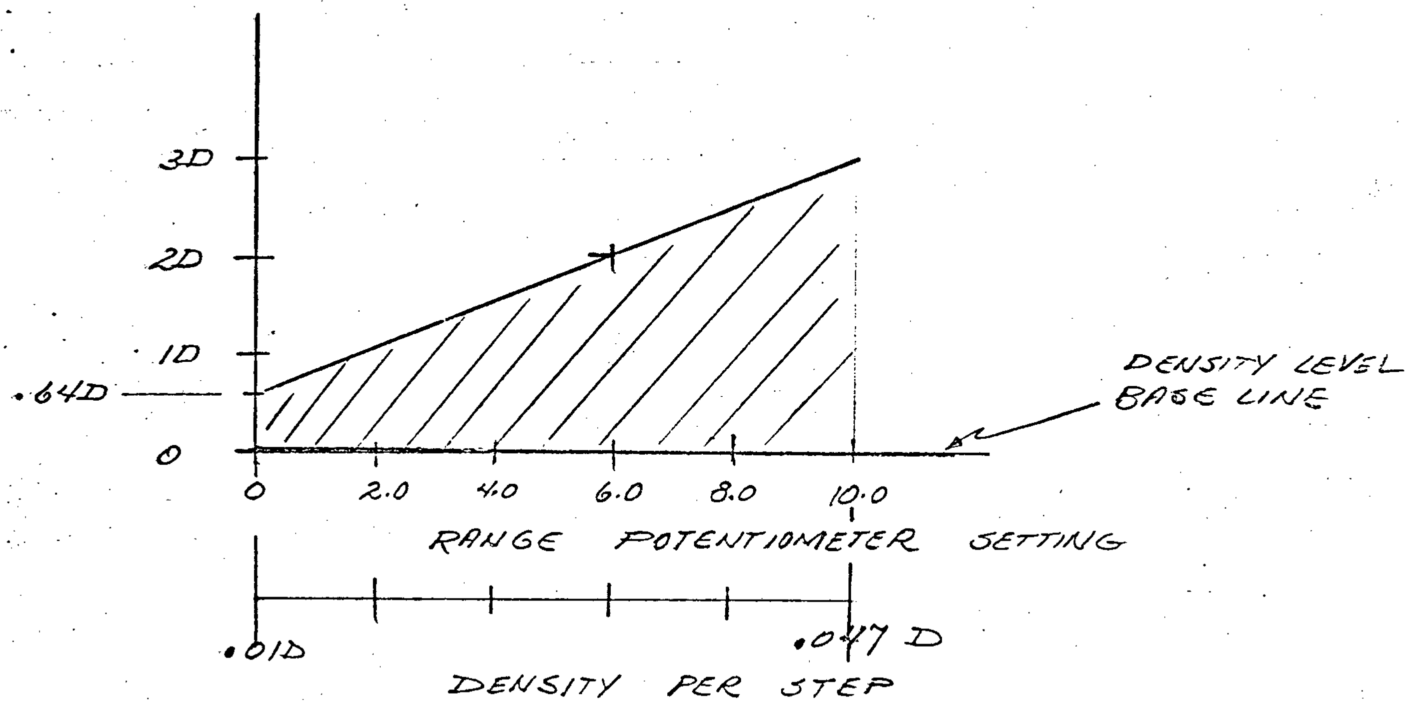

Figure 10. Density Range Control

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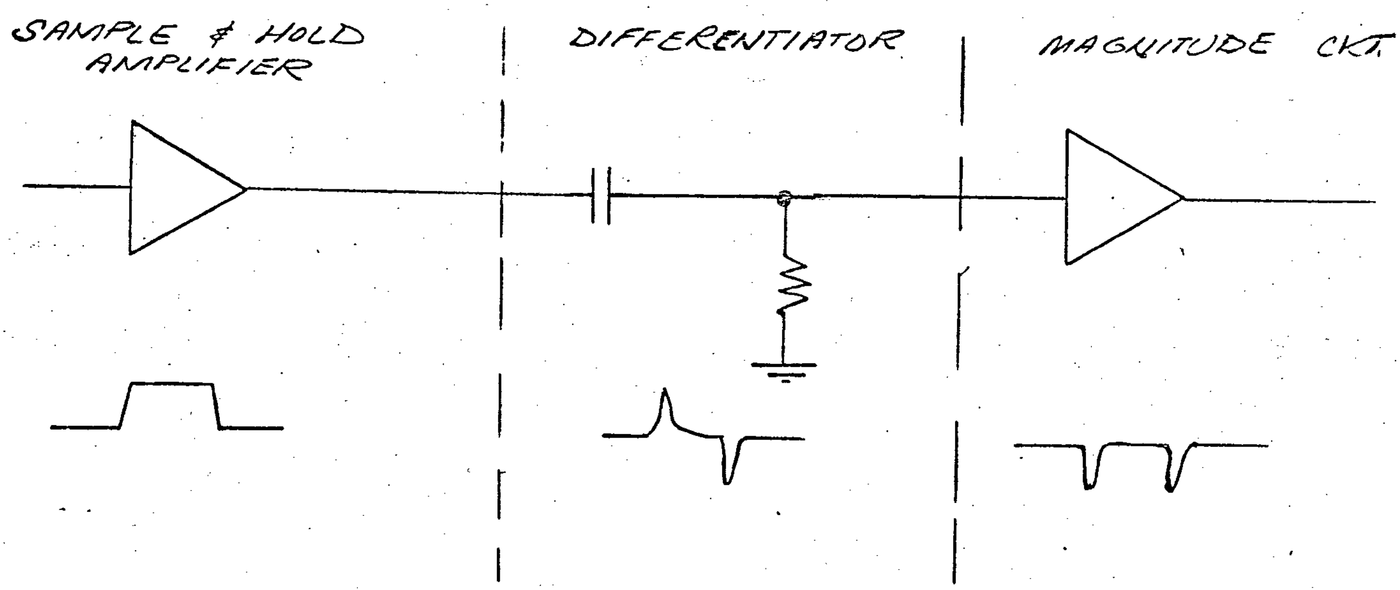

Figure 11. Signal Waveforms

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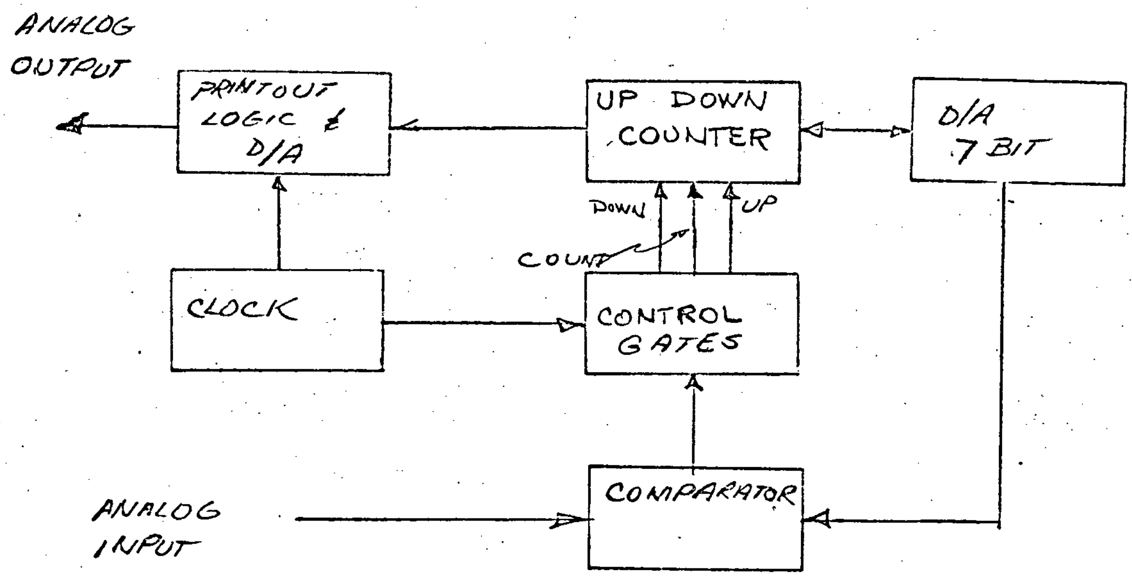

Figure 12. Digital Quantizer Block Diagram

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OPERATING PROCEDURE

Basic Control Settings

The Image Quantizer control panel is shown in Fig. 2; correct setting and adjustment of these controls is essential for proper operation of the IQ.

In setting up the IQ for operation, make the following initial control settings:

1. Turn the MINIMUM DENSITY control to the full counterclockwise position (a setting of zero).
2. Turn the DENSITY RANGE control to the full clockwise position (a setting of 10).
3. Turn the MODE OUTPUT selector switch to the DIGITAL X position.
4. Turn the CONTRAST control to the full clockwise position.
5. On the printer control panel (Fig. 1) set the SCAN control to 200 lines per inch. (This control is located to the right of the meter on the upper portion of the housing.)

These settings have placed the IQ in its maximum range of about 3D (3 density units) and it is now ready to scan in the direct quantize mode at a rate of 200 lines per inch.

The POWER on switch energizes the entire system electronics; the POWER ON indicator light is lit when the power is applied. After a 45 second warm-up period, the HIGH VOLTAGE READY light (red) on the control panel is lit to indicate that the plate voltage has been applied to the photomultiplier. The IQ is now ready.

Select a medium size aperture and place it in the slot in the photomultiplier assembly, Fig. 6. Be sure that the aperture is firmly in place and held by the ball detent to assure no light leaks. Access to the photomultiplier may be had by removing the door on the right side of the printer-scanner front panel, Fig. 6.

The remaining controls on the IQ control panel are not used or required at this time. These controls and their functions are:

DIFFERENTIAL TIME CONSTANT. Adjusts the differential time constant in decade steps from 0.01 to 0.0001. It is only operational in the Analog X' mode of operation.

Meter, METER FUNCTION Selector Switch, and ZERO CALIBRATE. These items on the panel are used to set up a particular specimen where range and minimum density level adjustments are desired.

a. With the METER FUNCTION switch in the MIN DENSITY position and the ZERO CALIBRATE control depressed, the meter indicates the minimum density level from 0D to 3D — interpolation of the meter scale is necessary.

b. With the METER FUNCTION switch in the INPUT MONITOR position, the output of the photomultiplier amplifier is monitored. The absolute specimen density can be determined from the meter indication when it is compared with the calibration curve supplied.

c. With the METER FUNCTION switch in the DENSITY RANGE position, the output of the range and level amplifier is monitored. Since the response of the meter is slower than the pulse rate being monitored, only a relative indication of the mid-range of operation can be determined.

NOTE

The MINIMUM DENSITY control is affected by the DENSITY RANGE control; consequently, it should be adjusted after the DENSITY RANGE control is set to the desired density per step.

Tape the specimen to the glass drum making sure not to place the specimen or the tape in the narrow clear area between the two black lines on the drum .

Move the scanning carriage to the left hand edge of the specimen by moving the indicator handle below the specimen drum. Move the scanning stop to the right hand edge of the specimen. These are located in the top and bottom slots of the scanning scale, respectively. When the IQ scanning carriage reaches the end stop, it will shut off automatically. The scanning process may be stopped at any time by depressing the DENSITY button provided (see Fig. 9).

Place a sheet of Gestefax copy paper, smooth side facing out, on the printing drum and lock in place with the holding bar provided. Be sure that the holding bar is firmly in place so that it will not loosen and fall out during operation.

NOTE

Possible damage to the stylus holder, photomultiplier, and glass drum could result if the holding bar comes loose during operation.

To start the scanning process, turn the operating knob, located in the center of the upper panel, clockwise until it latches in places. The IQ will automatically start to scan. The operating knob turns on the scanning motor, engages the magnetic drive clutch, and places the stylus against the printing drum.

Complex Operation

After the basic set up and initial run has been made, sensitivity of the IQ may be increased by adjusting the DENSITY RANGE and MINIMUM DENSITY controls. The interrelation of these controls is shown graphically in Fig. 10.

NOTE

The density level (MINIMUM DENSITY) control is dependent upon the DENSITY RANGE setting. Use the meter to adjust these controls as described elsewhere in these instructions.

As an example, suppose a given specimen sample to have a density range of 2D with a minimum density of 1D. If it is desirable to get all 64 contour levels in the 2D range, the DENSITY RANGE control should be set at approximately 6.0. To set the minimum density component to 1D the density level control must be adjusted (this is accomplished by use of the meter—ref. page 17). Scanning of the film at these settings will produce the desired 64 increments over the 2D range. This corresponds to a 0.031D per step sensitivity.

Differential Mode Operation

When differential output is desired, place the MODE OUTPUT selector switch to the ANALOG X′ position. Turn the MINIMUM DENSITY level control to zero and adjust the DENSITY RANGE control to the desired sensitivity. The MINIMUM DENSITY level control is not used in this mode of operation. Select one of the three differential time constants by setting the DIFFERENTIAL TIME CONSTANT control to 0.01, 0.001, or 0.0001. The machine may be operated in the same manner as before.

The time constant settings, IQ sensitivity, and aperture size in this mode of operation are dependent upon the rate of change of density on the film specimen being scanned. The operator must adjust the machine for best results in this mode of operation.

NOTE

> The differential sampled is only in the direction of scan. Rotating the film specimen 90° would produce a different printout.

Additional Controls

A bandpass filter cutoff switch is located within the cabinet on the sweet circuit chassis, Fig. 4. The IQ has been designed to operate at 10 kKz, but since system noise increases with bandwidth, this control has been provided for the operator to reduce the bandwidth of the photomultiplier circuitry to reduce the noise output even further. This is desirable for specimens that have a slow change in density levels.

A gain adjustment control is provided on the same chassis, although it is not marked or shown in the illustrations. This control has been set to cover a range of 3D and to produce a sensitivity of 0.01D per step. If this control is turned clockwise, it reduces the maximum density range and increases the sensitivity proportionally.

CIRCUIT THEORY

Analog

Density readings are made by using a photomultiplier in a feedback loop where the photomultiplier anode current is held constant regardless of the light input. The anode current is held constant by varying the dynode voltage across the photomultiplier. The circuit output is a voltage proportional to the log of the light intensity which is a measure of the density of the film (see system block diagram, Fig. 8).

The output of the photomultiplier circuit is then fed into the sample and hold circuit producing a signal which is the difference between the clear "0" density output and the film sample density. The sample and hold is refreshed every revolution of the drum. It is most important that the area in the sample portion of the scanning drum (the narrow band between the two black lines on the glass drum) be kept clean and free from film specimens or other obstructions, so that the maximum stability can be obtained from the sample and hold circuit.

NOTE

The sole purpose of the sample and hold circuit is to eliminate system drift.

The output of the sample and hold circuit is fed into a direct mode circuitry or differentiator mode circuitry by the MODE OUTPUT selector switch on the control panel. In the direct mode of operation (DIGITAL X position) the signal is fed directly into a magnitude circuit. The magnitude circuit accepts positive and negative signals with respect to system common and converts it to a negative signal equal to the magnitude of the input signal.

The prime reason for the magnitude circuit is in the differential mode of operation. The typical waveforms shown in Fig. 11 depict the electrical characteristics of the magnitude circuit when a step in the density occurs.

Quantizing the magnitude of the differential signal rather than the actual differential is essential in keeping with a symmetrical intelligible output. The output of the magnitude circuit can vary between 0 and -10 V depending upon the absolute density or the rate of change in density.

This voltage is fed into the density range and level amplifier. Increasing the gain of the amplifier decreases the range of the IQ producing up to a minimum of 0.01D per step. The MINIMUM DENSITY or density level control presents an offset voltage to the amplifier to change the minimum density starting point.

Digital

The output of the density range and level amplifier is fed into a digital quantizer which operates as shown in the block diagram, Fig. 12.

A 200 kHz clock operates the up-down counter. The output of the counter is continually monitored by a 7-bit D/A converter. The D/A converter output is fed into one input of an analog comparator. The analog input signal is fed into the other input. When a zero crossing is detected, the direction of the counter is reversed and the count is stopped until the end of the next hold period.

The sample and hold period is generated by allowing 8 clock pulses into the counter and then holding the next 4 clock pulses. The total period is 12 clock pulses. If only 1 clock pulse is needed to update the up-down counter, 11 clock pulses will be gated off before the counter is updated again.

The three least significant bits in the up-down counter are continually monitored by the printout logic. At the beginning of the hold cycle, a printout command produces one of four discrete levels (shades) on the print drum by way of an amplitude modulated pulse four clock pulses wide.

The printout logic also has a Digital X' mode of operation. In this mode, the number of counts per sample period are monitored and printed out in the same manner as the direct (Digital X') mode of operation.

Printout is accomplished by pulsing the stylus located behind the door on the left of the IQ beneath the printing drum. The stylus consists of a mount in which the removable stylus holder and stylus are located. The stylus holder is held secure by two spring clips and its electrical contact pins. An interlock is provided that turns off the pen voltage when this door is open. The door must be closed before attempting to operate the Image Quantizer.

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SPECIFICATIONS

Illumination	Transmission
Maximum Density Range	3.0D
Minimum Density Range	0.6D
Minimum Sensitivity	0.047D
Maximum Sensitivity	0.0094D
Quantizable Steps	64
Linearity	± 2.5%
Printout	4 shades: White, Light Grey, Dark Grey, and Black -- on electrosensitive paper
Specimen Area	8 x 11 inches
Printed Speed	Resolution 200 lines/inch— 8 minutes Resolution 400 lines/inch—16 minutes Resolution 600 lines/inch—24 minutes
Input Data	Transparencies only
Output Modes	Quantized Derivative Quantized .01, .001, .0001 Time Constants
Scanning Apertures	0.5 mm — 10 mm
Bandwidth	20 kHz — setable in steps to 2.5 kHz
Scanning Resolution	5 lines/mm

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MAINTENANCE

1. Paper — Electro Sensitive Gestefax.

2. Bearing Lubrication — If the drum bearings get noisy, a light oil may be used to quiet them provided only a small amount is used. See Fig. .

3. Stylus — Cleaning is described below.

SERVICING INSTRUCTIONS

1. STYLUS

A Stylus will cut from 10 - 30 Stencils before it needs replacing, depending on the subject matter.

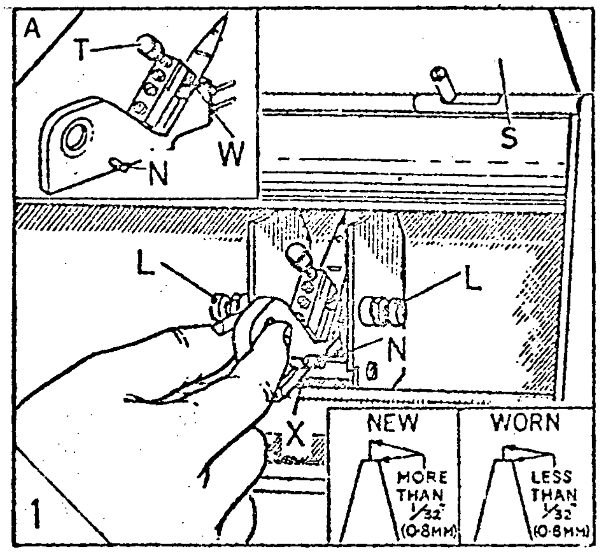
The Stylus should be inspected periodically for wear and condition. If the fine wire (Stylus) is worn down to within 1/32" (0.8 mm) or if the wire is broken a new Stylus should be fitted. A Stencil cut with a worn Stylus will show a mottled effect and the position of the subject matter will be reproduced lower than the original.

The Stylus should be checked and replaced as follows:-

a. Illustration 1. Switch off machine. Move Scanning Carriage to extreme left hand position, open Stylus Access Door 'S' and pull out Stylus Holder.

b. Examine Stylus for wear and condition. The fine wire should project not less than 1/32" (0.8 mm). If correct replace Stylus Holder in machine. If incorrect unscrew Screw 'T' and remove Stylus. Fit new Stylus (rivet head uppermost) between pad 'W' and bottom of Holder (as shown in illustration 1A), ensure that its flat end rests squarely against the Holder and tighten Screw. Replace Stylus Holder in machine, ensuring that the pins 'N' locate under Spring Clips 'X'.

NOTE: Ensure that the Spring Slips 'X' hold the Stylus Holder steady.



c. Check that the Stylus lightly contacts the Stencil; if necessary carefully bend upwards the flat strip to which the fine wire is soldered.

d. Illustration 1. Ensure that the Screws 'L' and Lock Nuts are secure and that the Stylus Holder is held secure in its Bracket. If loose, position Stylus Holder Bracket centrally and secure Screws and Lock Nuts.

e. Close Stylus Access Door.